

## Remarks

### I. Status of claims

Claims 1-20 are pending.

Claims 1 and 13 are independent claims.

Claims 2-12 depend from independent claim 1 and claims 14-20 depend from independent claim 13.

### II. Claim objections

The Examiner has objected to claims 3 and 19. Claims 3 and 19 have been amended to address the Examiner's concerns.

### III. Claim rejections

#### A. Claims 1 and 5-17

The Examiner has rejected claims 1 and 5-17 under 35 U.S.C. § 103(a) over Parayanthal (U.S. 6,057,954) and Akiyama (U.S. 2003/0138179).

#### 1. Independent claim 1

Independent claim 1 recites:

1. A device, comprising:
  - an input microstrip line and an output microstrip line each respectively having a length less than one-quarter of a target wavelength corresponding to a target operating frequency, a characteristic impedance greater than a target source impedance, and a series inductance at the target operating frequency; and
  - an electro-absorption modulator having a signal electrode with a length less than one-quarter of the target wavelength, a characteristic impedance less than the target

source impedance, and a shunt capacitance at the target operating frequency;

wherein the input microstrip line, output microstrip line, and the electro-absorption modulator are incorporated into a distributed low-pass filter transmission line circuit having a characteristic impedance substantially matching the target source impedance at the target operating frequency.

The Examiner has asserted that:

Regarding claim 1, Parayanthal discloses an electro-absorption modulator device (Fig. 2), whose electrical equivalent circuit is shown in Fig. 3. The device comprises an input microstrip line 214 and an output microstrip line 216, each having a series inductance L1 and L2, respectively, and a resulting characteristic impedance at the operating frequency.

A microstrip line is a well-known term of art in the field of high-frequency circuits and devices. A microstrip line is a waveguide structure made from parallel metal strips on a dielectric substrate. A microstrip line guides high-frequency signals by confining an electromagnetic wave in planes transverse to the direction of propagation of the electromagnetic wave. The elements 214 and 216 in Parayanthal's electro-absorption modulated laser package are wires (see, e.g., col. 3, line 15); they are not microstrip lines. In addition, the wires 214 and 216 and the electro-absorption modulated laser 202 are not "incorporated into a distributed low-pass transmission line circuit," as recited in independent claim 1, because the wires 214 and 216 are not transmission lines.

The Examiner has cited Akiyama for the proposition that:

Akiyama discloses an electro-absorption modulator device (Fig. 8) comprising various segments of modulating elements 10A, each having a signal electrode 8b, and adjacent modulating elements being connected with microstrip lines 8a.

In FIG. 8, Akiyama shows a phase modulation device 1 that (¶ [0098]):

includes an electrically conductive substrate 2 and an optical waveguide core layer 3 formed on the substrate 2. It also includes insulating material portions 6 located at predetermined intervals on the substrate 2, thereby defining micro-optical modulator elements 10A (corresponding to the intervals) and gap regions 10B (corresponding to the insulating material portions) alternately formed.

In accordance with Akiyama's teaching, adjacent ones of the optical modulator elements 10A are connected by a respective "metal wiring (air bridge) 8a" (see ¶ [0101]). Terminal ones of the optical modulator elements 10A also are connected to a source 12 and a load 11 by similar metal wirings, as shown in FIG. 8.

Contrary to the Examiner's assertion, the input and output metal wirings connecting the terminal ones of the optical modulator elements 10A are not microstrip lines. Indeed, each of these wirings consists of only a single metal wire.

Thus, neither Parayanthal nor Akiyama discloses a device that has an input microstrip line and an output microstrip line, as recited in independent claim 1. Accordingly, there is no combination of Parayanthal and Akiyama that possibly could have led one of ordinary skill in the art at the time the invention was made to the inventive device recited in claim 1.

For at least these reasons, the Examiner's rejection of independent claim 1 under 35 U.S.C. § 103(a) over Parayanthal and Akiyama should be withdrawn.

## 2. Claims 5-12

Each of claims 5-12 incorporates the features of independent claim 1 and therefore is patentable over Parayanthal and Akiyama for at least the same reasons.

## 3. Independent claim 13

Independent 13 recites:

13. A device, comprising an electro-absorption modulator having a signal electrode with a distributed traveling wave structure comprising multiple spaced-apart signal electrode segments connected in series with each pair of signal electrode segments connected by a respective microstrip line.

The Examiner has acknowledged that Parayanthal fails to teach or suggest anything about an electro-absorption modulator having a signal electrode with a distributed traveling wave structure comprising multiple spaced-apart signal electrode segments connected in series with each pair of signal electrode segments connected by a respective microstrip line. In an effort to make-up for this failure, the Examiner has asserted that:

In Akiyama's electro-absorption modulator device, the signal electrode has a distributed traveling wave structure comprising multiple spaced-apart segments 8b connected via wires 8a.

The metal wirings 8a, however, are not microstrip lines. Indeed, each of the wirings 8a consists of only a single metal wire.

Thus, neither Parayanthal nor Akiyama discloses a device that includes "an electro-absorption modulator having a signal electrode with a distributed traveling wave structure comprising multiple spaced-apart signal electrode segments connected in series with each pair of signal electrode segments connected by a respective microstrip line," as recited in independent claim 13. Accordingly, there is no combination of Parayanthal and Akiyama that possibly could have led one of ordinary skill in the art at the time the invention was made to the inventive device recited in claim 13.

For at least these reasons, the Examiner's rejection of independent claim 13 under 35 U.S.C. § 103(a) over Parayanthal and Akiyama should be withdrawn.

#### 4. Claims 14-17

Each of claims 14-17 incorporates the features of independent claim 13 and therefore is patentable over Parayanthal and Akiyama for at least the same reasons.

#### B. Claims 2, 3, 18, and 19

The Examiner has rejected claims 2, 3, 18, and 19 under 35 U.S.C. § 103(a) over Parayanthal in view of Akiyama and Mayer (U.S. 5,793,516).

Claims 2 and 3 incorporate the features of independent claim 1 and claims 18 and 19 incorporate the features of independent claim 13. Mayer does not make-up for the failure of Parayanthal and Akiyama to teach or suggest the features discussed above in connection with independent claims 1 and 13. Indeed, in Mayer's optical modulator circuit, the modulation diode MD does not include an input microstrip line and an output microstrip line, as recited in claim 1. In addition, Mayer's optical modulator circuit does not include "an electro-absorption modulator having a signal electrode with a distributed traveling wave structure comprising multiple spaced-apart signal electrode segments connected in series with each

pair of signal electrode segments connected by a respective microstrip line,” as recited in independent claim 13.

Therefore, each of claims 2, 3, 18, and 19 is patentable over Parayanthal, Akiyama, and Mayer for at least the same reasons explained above.

C. Claims 4 and 20

The Examiner has rejected claims 4 and 20 under 35 U.S.C. § 103(a) over Parayanthal in view of Akiyama, Mayer, and Nagra (U.S. 6,590,691).

Claim 4 incorporates the features of independent claim 1 and claim 20 incorporates the features of independent claim 13. Nagra does not make-up for the failure of Parayanthal, Akiyama, and Mayer to teach or suggest the features discussed above in connection with independent claims 1 and 13. Indeed, Nagra's modulator chip 202 does not include an input microstrip line and an output microstrip line, as recited in claim 1. In addition, Nagra's modulator chip 202 does not include “an electro-absorption modulator having a signal electrode with a distributed traveling wave structure comprising multiple spaced-apart signal electrode segments connected in series with each pair of signal electrode segments connected by a respective microstrip line,” as recited in independent claim 13.

Therefore, each of claims 4 and 20 is patentable over Parayanthal, Akiyama, Mayer, and Nagra for at least the same reasons explained above.

IV. Conclusion

For the reasons explained above, all of the pending claims are now in condition for allowance and should be allowed.

Charge any excess fees or apply any credits to Deposit Account No. 50-1078.

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Serial No. : 10/642,931  
Filed : Aug. 18, 2003  
Page : 11 of 11

Attorney's Docket No.: 10020832-1  
Reply to Office action dated March 2, 2005

Respectfully submitted,

Date: May 23, 2005



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